

NASA TECH BRIEF

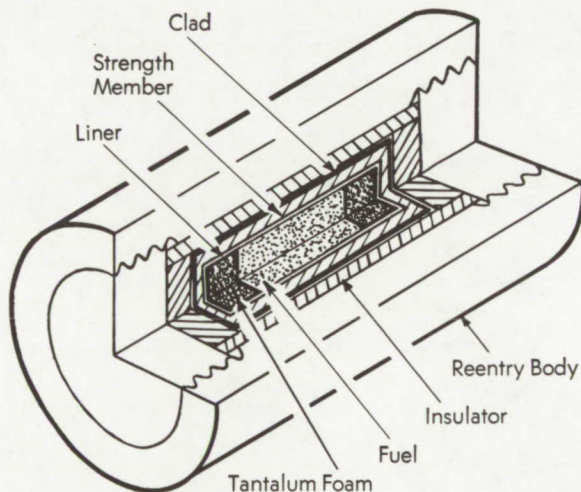
Ames Research Center



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Radioisotope Heater

Radioisotope heaters are superior to electrical heaters in remote locations where equipment must be kept warm. Radioisotope heaters require no external power source; their useful lifetime often is



longer than the equipment being kept warm, for example, ^{238}Pu loses less than 10% of its maximum heat-generating capacity in seven years.

A one-watt radioisotope heater unit has been developed; it is about the size of a flashlight cell (22-mm diameter, 4.7-mm long, 55 grams) and can be safely handled for several minutes without danger. The unit is completely sealed and can withstand the buildup of helium pressure from isotope disintegration for up to 30 years. A number of units can be safely grouped together when more than one watt of heat is required.

The structure of the unit is shown in the diagram; the fuel is a solid-solution cermet containing $^{238}\text{PuO}_2$. Tantalum foam is placed in the space between the

ends of the liner and the fuel in order to reduce fuel rattle and to provide voids for the helium which is given off by disintegration of the radioisotope. The liner of tantalum-10% tungsten forms the initial fuel encapsulator; the tantalum alloy strength member is the second encapsulator. Double encapsulation eases capsule fueling and decontamination of external surfaces; however, the primary purpose of the strength member is to maintain unit integrity and reduce the possibility of radioisotope release. Also, the strength member is clad with platinum-20% rhodium to minimize chemical attack by the environment. The reentry member is used for space missions; it is made of pyrolytic graphite to insulate the strength member from reentry thermal environments and of polycrystalline graphite to provide ablation protection to the heater unit; for nonspace application, the shield (27 grams) can be eliminated without alteration of performance or safety features.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Reference: B74-10051

Patent status:

NASA has decided not to apply for a patent.

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Category 03